

Sotalia fluviatilis.

By Vera M. F. da Silva and R. C. Best

Published 17 May 1996 by the American Society of Mammalogists

Sotalia Gray, 1866

Sotalia Gray, 1866a:401. Type species is *Delphinus guianensis* van Bénédén, 1864.

Tucuxa Gray, 1866b:213. Type species is *Steno tucuxi* Gray, 1856 (= *Sotalia fluviatilis*).

CONTEXT AND CONTENT. Order Cetacea, Suborder Odontoceti, Superfamily Delphinoidea, Family Delphinidae, although considered by some authors to be Family Stenidae (Fraser, 1966), Subfamily Steninae (Mead, 1975). The genus *Sotalia* is monotypic.

Sotalia fluviatilis Gervais, 1853

Tucuxi

Delphinus fluviatilis Gervais, 1853:148. Type locality Marañon River above Pebas, Loreto, Peru.

Delphinus pallidus Gervais, 1855:94. Type locality Loreto, Peru. "... ce dauphin a été pris à Nauta, dans la région de l'Amazone qu'on nomme le Marañon."

Steno tucuxi Gray, 1856:158. Type locality upper parts of the Amazon River near Santarém, Pará, Brazil.

Delphinus guianensis P. J. van Bénédén, 1864:27. Type locality mouth of the Surinam River, Surinam.

Sotalia brasiliensis E. van Bénédén, 1875:8. Type locality Baía de Guanabara, Rio de Janeiro, Brazil.

Sotalia fluviatilis van Bénédén and Gervais, 1880:596. First use of current name combination.

CONTEXT AND CONTENT. Context as for the genus. Some authors (e.g., Nowak and Paradiso, 1983) accept two subspecies (as follows). However, others consider that populations of *Sotalia fluviatilis* are not subspecifically distinct, but exhibit different ecotypes in marine and riverine habitats (Borobia et al., 1991; da Silva, 1994; da Silva and Best, 1994; Mitchell, 1975).

S. f. fluviatilis Gervais, 1853:148 (riverine).

S. f. guianensis E. van Bénédén, 1875:8 (marine).

DIAGNOSIS. The skull of *Sotalia fluviatilis* differs from that of other dolphins in the shape of the well-separated pterygoid hamuli and by having fewer small teeth in each mandibular row. In the Amazon drainage area, the only sympatric dolphin is *Inia geoffrensis*, which is easily distinguished from *S. fluviatilis* by its low dorsal keel and its surfacing behavior. In its marine range, *S. fluviatilis* is smaller than all other dolphins except *Pontoporia blainvilliei*. However, it can be distinguished from *P. blainvilliei* by the length of the mandible, which is only slightly longer than the upper jaw in *S. fluviatilis*, but is extremely long and narrow in *P. blainvilliei* (da Silva and Best, 1994). Other co-occurring marine forms differ in various bodily features. For example, *Tursiops* has a larger hooked dorsal fin; *Steno* has a conical-shaped head, longer gape, larger eye, and a broad-based, tall dorsal fin; and *Stenella* has a long beak and triangular dorsal fin. *Delphinus* and *Stenella* are also distinguishable from *S. fluviatilis* by body coloration (Best et al., 1986; Martin, 1990; Pinedo et al., 1992). The tucuxi is gray on the sides and dorsum, but *Delphinus* has yellowish-ochre patches on the sides of the body and *Stenella* has stripes and spots that vary in pattern among species (Martin, 1990).

GENERAL CHARACTERS. *Sotalia fluviatilis* is a small delphinid with a moderately long, slender beak that is triangular at the base, 26–36 teeth in each mandibular ramus, and a small rounded melon (Fig. 1). The dorsal fin is triangular, short, high, and has a posteriorly curved hook (Best et al., 1986; Bittencourt,

1984; da Silva, 1994; de Carvalho, 1961; van Bree, 1975). Flippers are slightly broader than in other coastal oceanic dolphins, but flukes are similar in shape. The eyes are about 18 mm in diameter and have black countershading around the eyelids. The iris is brown and the pupil is a longitudinal ellipsoid (de Carvalho, 1963). Length of the rostrum is 55–60% of condylobasal length in specimens from the central Amazon ($n = 15$ —da Silva and Best, 1994), Lake Maracaibo ($n = 3$ —Casinos et al., 1981), and Surinam ($n = 4$ —Husson, 1978; Williams, 1928). The skull has a typically delphinid degree of asymmetry (Ness, 1967).

The tucuxi is dark gray on the dorsum and rosy pink to light gray on the ventral side, with the two colors separated by a distinct line that originates on the rostrum at the gape of the mouth and passes below the eye to the leading edge of the flippers. A lateral area of light gray occurs behind the pectoral fin and another extends from approximately mid-body to the level of the anus. The pectoral fin and flukes are dark gray underneath. After death, the body color changes; the gray parts of the body become very pale and the pink belly becomes yellowish. In some marine-dwelling individuals there is another light streak that slopes anteriorly and ventrally from the upper edge of the caudal peduncle for 10–15 cm. Marine *S. fluviatilis* is larger than the river-dwelling ecotype. Mean body length ($\pm SD$) for the marine ecotype is 1.7 ± 0.2 m ($n = 17$ —Husson, 1978; Lodi and Capistrano, 1990; Perrin and Reilly, 1984), with the largest recorded adults being a 1.87-m male and a 2.06-m female (Barros, 1991). Mean body length ($\pm SD$) for the riverine ecotype is 1.4 ± 0.2 m, with the largest recorded adults being a 1.49-m male and a 1.52-m female ($n = 27$ —Best and da Silva, 1984; da Silva, 1983, 1994; da Silva and Best, 1994). Mean body measurements (cm $\pm SD$) for the marine ($n = 4$ or 5) and riverine ($n = 8$) ecotypes, respectively are: from tip of jaw to blowhole, 25.9 ± 1.5 , 26.4 ± 3.0 ; from tip of jaw to insertion of flippers, 41.2 ± 3.7 , 39.0 ± 18.3 ; from tip of jaw to angle of gape of mouth, 22.9 ± 2.7 , 22.7 ± 0.9 ; maximum length of flippers, 29.2 ± 2.2 , 24.8 ± 1.7 ; and length of flukes tip to tip, 42.2 ± 2.8 , 39.4 ± 2.8 . Additional measurements are: marine ecotype, maximum width of pectoral fin, 11.4 ± 0.6 ; and riverine ecotype, length of dorsal fin 23.0 ± 1.7 , height of dorsal fin, 10.3 ± 0.7 , and maximum depth of flukes, 13.1 ± 0.6 .

Marine and riverine ecotypes also differ slightly in coloration, dimensions of the orbital region, and numbers of teeth (Borobia, 1989; da Silva and Best, 1994). For example, marine *S. fluviatilis* has significantly more upper teeth (30–36; $n = 38$) than the riv-



FIG. 1. Live adult female *Sotalia fluviatilis*, from Lago Tefé, Amazon River, Brazil. Length of body is 139.5 cm.

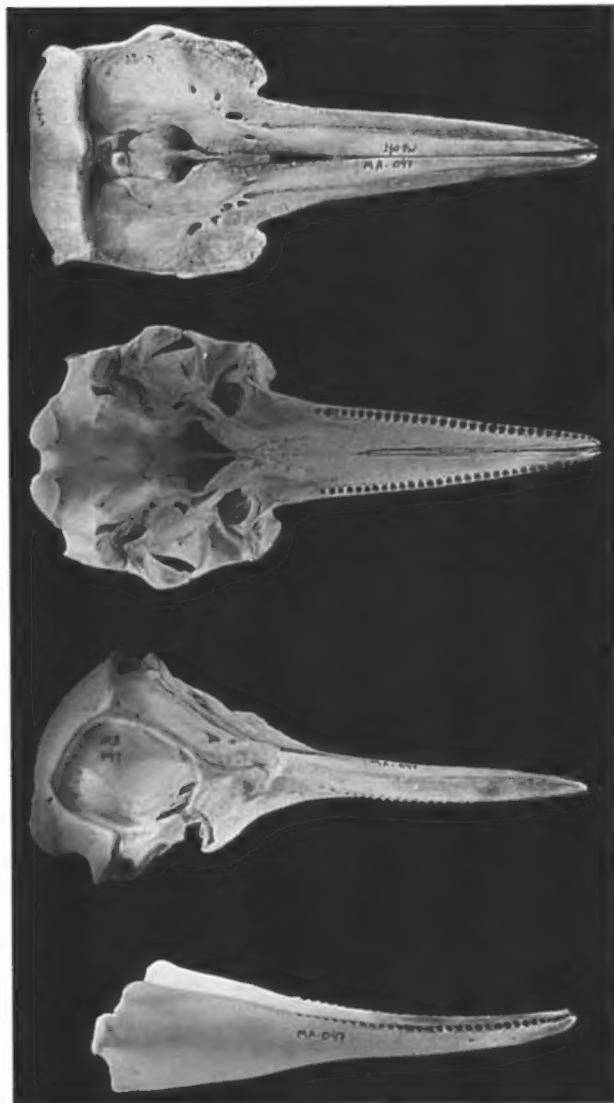


FIG. 2. Dorsal, ventral, and lateral views of the cranium and lateral view of the mandible of adult male *Sotalia fluviatilis* (Divisão de mamíferos aquáticos No. 047). Maximum length of cranium is 33.7 cm.

erine ecotype (28–35, $n = 38$; $t = 3.35$, $P < 0.05$ —Borobia, 1989).

DISTRIBUTION. The tucuxi is endemic to the Amazon River drainage (Fig. 3). Records exist from Belém through main tributaries of the Amazon Basin in Brazil to Peru in the Ucayali and Putumayo Rivers and their tributaries, such as the Marañón and Samira Rivers to the south and the Napo and Tigre Rivers to the north (Best and da Silva, 1984; Borobia et al., 1991; da Silva and Best, 1994; de Carvalho, 1961; Grimwood, 1969; Kasuya and Kajihara, 1974; Layne, 1958; Neville et al., 1976; Zam et al., 1970). The tucuxi occurs as far upriver as Ecuador in the Napo, Coca, Pastaza, Bobonaza and Lagarto Cocha Rivers (Best, 1984; E. Asanza, pers. comm.; L. von Fersen, pers. comm.). It does not pass the rapids at São Gabriel da Cachoeira on the upper Rio Negro and thus does not occur in the upper Orinoco River (da Silva, 1994; da Silva and Best, 1994; Meade and Koehnken, 1991). A single sighting of *Sotalia fluviatilis* has been recorded in the Orinoco River, between Cabruta and Caicara, <50 km from the Cassiquiare canal (Borobia et al., 1991), but the report is questionable because the species was not sighted by other biologists working in the middle and upper Orinoco Rivers (Kasuya and Kajihara, 1974; Meade and Koehnken, 1991; O'Shea et al., 1986; Trebbau and van Bree, 1974). The species may have been confused with *Inia geoffrensis* which, in the upper Rio Negro, is smaller and darker than in the

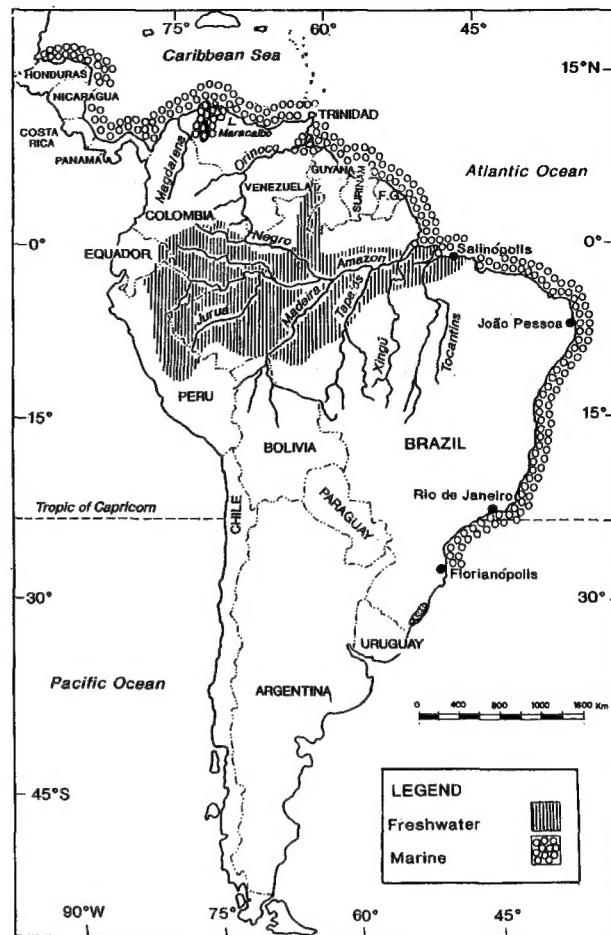


FIG. 3. Distribution of *Sotalia fluviatilis*.

Amazon river (R. Barthen, in litt.; R. Best, in litt.). The tucuxi also occurs in Colombia in the Amazon, Putumayo and Caquetá Rivers (Layne, 1958; Obregon et al., 1988; Vidal, 1990), but not in the Orinoquia River drainage (S. Kendal and F. Trujillo, pers. comm.).

Marine *Sotalia fluviatilis* is distributed along the tropical and sub-tropical Atlantic coastlines of South and Central America. Northern records include Honduras ($15^{\circ}58'N$, $85^{\circ}42'W$), where the species has been seen ≥ 1 km upriver (H. Edwards, in litt.); Nicaragua; Panamá ($\sim 9^{\circ}22'N$, $79^{\circ}54'W$); and Colombia (Bössenecker, 1978). Lake Maracaibo in Venezuela is considered a principal area of occurrence (Casinos et al., 1981; Hershkovitz, 1963; Osgood, 1912). The species occurs as far as 130 km from the mouth of the Orinoco River (Pilleri, 1979; Trebbau and van Bree, 1974) and possibly also as far as Ciudad Bolívar, about 300 km upriver (Kasuya and Kajihara, 1974). Similar observations have been made in rivers of Ceará and Paraná states in Brazil, where the marine tucuxi penetrates several kilometers upriver, although no correlation with salinity has been found (R. Almeida, pers. comm.; R. Zanellatto, pers. comm.). In Trinidad (van Bree, 1975) and Guyana, the species is known from the Demerara, Cuyuni, Mazaruni, and Essequibo Rivers (Herald, 1967; van Bénédien, 1864; Williams, 1928). In Surinam, this species is common near Paramaribo and as far upriver as Domburg and Paranam (Husson, 1978). Along the coast of Brazil, *Sotalia fluviatilis* was recorded by several authors as having an extensive and continuous distribution (Borobia et al., 1991; Pinedo et al., 1992) with the southern limit in Florianópolis ($27^{\circ}35'S$, $48^{\circ}34'W$; Simões-Lopes, 1988). The principal limiting factor for the riverine ecotype is the presence of rapids and small channels in the Amazon River drainage (da Silva, 1983, 1986; da Silva and Best, 1994; Layne, 1958) and for the marine ecotype low water surface temperatures (Borobia et al., 1991; Simões-Lopes, 1988). There are no fossil records of *Sotalia fluviatilis*, although this species may have had an Atlantic origin and subsequently invaded the Amazon system (Brooks et al., 1981).

FORM AND FUNCTION. The vertebral formula is 7 C (atlas and axis fused in adults), 12 T, 12 L, and 22–25 Ca, total 53–56 ($n = 19$). The thoracic and lumbar vertebrae have a well developed oblique process that secures one vertebra firmly to the other, eliminating lateral torsion of the body (da Silva and Best, 1994).

Mean hematological values ($n = 30$) for marine *Sotalia fluviatilis* in captivity ($n = 9$) are: hemoglobin, 13.4 g/dl (range 11.0–15.5); Na^+ , 150 Meq/l (range 143–160); K^+ , 3.9 Meq/l (range 3.4–4.4); white blood cell count, 9,163 $\text{Nu}/\mu\text{l}$ (range 4,000–16,600); neutrophils, 56.5% (26–93); lymphocytes 27% (6–61); monocytes 2.5% (0–7); eosinophils 13.5% (1–25); and basophils, 0% (0–3—van Forest, 1980).

Selected organ masses (in g) from adult animals (35–53 kg body mass) from the central Amazon Basin are: left kidney, 105–174 ($n = 8$); left lung, 293–685 ($n = 8$); adrenal (one), 2.2–5.0 ($n = 6$); heart, 125–264 ($n = 7$); and liver, 920–1,600 ($n = 7$). The following organs comprise a constant percentage of the body mass: kidney (0.6%); heart (0.5%), liver (2.5%), and lungs (2.4%). Cranial volume is 546–627 ml ($n = 8$; da Silva, 1994; da Silva and Best, 1994). Brain:body mass ratio in one animal was 0.0163 (688g/42.2 kg—Morgane and Jacobs, 1972).

The optic nerve of *Sotalia fluviatilis* has about 19,500 optical fibers and a tapetum is present (Morgane and Jacobs, 1972). The eye is large, but vision may not be acute (Pilleri, 1982). However, visual stimuli play an important part in courtship display in captive animals (Terry, 1983). Acoustic fatty tissue in the melon of *Sotalia fluviatilis* contains short-chain (C_5) isovaleric acids typical of Delphinidae, in contrast with long-chain triglycerides in the blubber (Ackman et al., 1975; Litchfield et al., 1975).

Sotalia fluviatilis has a large non-glandular forestomach and smaller true stomach leading to an non-differentiated intestine, which lacks a caecum and obvious colon. Anal tonsils are found in the rectal portion of the intestine (Chaves and da Silva, 1988). Mean intestinal lengths ($\pm SD$) are 6.1 ± 0.26 times that of the body (range 6.0 to 9.6 m; da Silva, 1983; da Silva and Best, 1994).

ONTOGENY AND REPRODUCTION. The body length at which marine *S. fluviatilis* reaches sexual maturity is between 160–170 cm (Bössenecker, 1978), and adult size is attained when there are five or more growth layer groups (GLG's) in the dentine (Borobia, 1989). Using testis weight as an index, males of the riverine ecotype reach sexual maturity at a body length >139 cm. Adult males may have active or inactive testes. When active, testes are $>5\%$ of body mass and average tubule diameter ranges from 106 to 232 μ (da Silva, 1994). The breeding system is polyandrous and involves sperm competition (Best and da Silva, 1984). Females mature at a body length between 132 and 137 cm (Best and da Silva, 1984). Females of the marine ecotype have been recorded lactating at body lengths of 167 cm, 172 cm, and 180 cm (Bössenecker, 1978; de Carvalho, 1963), and a 182-cm female had a 60-cm fetus. The birth size of *S. fluviatilis* was estimated to be from 60 to 65 cm for the marine ecotype (Bössenecker, 1978) and from 71 to 83 cm for the riverine ecotype (Best and da Silva, 1984). Ovulation occurs only from the left ovary (Best and da Silva, 1984; Harrison and Brownell, 1971). The gestation time of marine *S. fluviatilis* is estimated at 11 to 12 months (Perrin and Reilly, 1984), with birth occurring during the winter on the Guyanan coast (Bössenecker, 1978) and throughout the year in southern Brazil (Schmiegelow, 1990). The estimated fetal growth rate of riverine *S. fluviatilis* is 8.5 cm/month and post-natal growth 2.5 cm/month. Birth occurs during the season of low water (October–November) after a gestation of 10.2 months (Best and da Silva, 1984). Although there is no hair on the rostrum of the adults, four to seven pairs of thick hairs were found on the rostrum of two fetuses collected in the central Amazon Basin (da Silva and Best, 1994).

ECOLOGY. In freshwater, the only possible predator of tucuxi is the bull shark (*Carcharhinus leucas*), which occurs in the Amazon River system (Werder and Alhanti, 1981). Along the coast many potential predators exist, such as several species of shark and the killer whale (*Orcinus orca*). A killer whale has been recorded with remains that are probably of this species in its stomach (Castello and Pinedo, 1986).

S. fluviatilis has been intentionally caught to be used as bait for sharks in Marajó Bay, northern Brazil (Pinedo, 1985) and along the Brazilian coast (Barros, 1991; Lodi and Capistrano, 1990). In-

cidental capture in fisheries occurs throughout most of their distribution (Bittencourt, 1984; Borobia and Barros, 1989; Geise and Borobia, 1987, 1988). Natural mortality rates are unknown.

In southeast Brazil, *S. fluviatilis* feeds upon pelagic clupeids (*Trichurus lepturus* and *Pellona barbieri*), demersal sciaenids (*Cynoscion jamaicensis*, *C. striatus*, and *Porichthys porosissimus*), and neritic cephalopods (*Loligo* spp. and *Lolliguncilla brevipes*—Borobia and Barros, 1989). *Sotalia fluviatilis* feeds on anchovies in southern Brazil (Simões-Lopes, 1988), and on fish and shrimps in Surinam (Husson, 1978). In Guyana, one specimen had the remains of 32 small herring-like fish, four small catfish, and several crystalline lenses in its stomach (Williams, 1928). In the Amazon region, a total of 28 species of fish comprising 11 families were identified in stomachs, with Curimatidae occurring in 52%, Sciaenidae in 39%, and siluriforms in 54% of the animals analyzed ($n = 29$). The maximum body length of fish eaten was 37 cm. The greatest diversity in diet occurred during periods of receding and lowest river levels when fish are more concentrated (da Silva, 1983, 1986; da Silva and Best, 1994).

Parasitic trematodes include: *Amphimeris lancea*, found in bile ducts of the liver of *Sotalia fluviatilis* from the Amazon region, and *Nasitrema attenuata*, found in the respiratory tract of *S. fluviatilis* from the coast (Gibson and Harris, 1979; Greenwood et al., 1979). The occurrence of trematodes in pancreatic ducts was also noted, as was an unidentified cyst in a glandular stomach (Grafton, 1968). The three types of nematodes recorded for *Sotalia fluviatilis* are *Halocercus brasiliensis*, from lungs of individuals from the Colombian and Brazilian coasts, and *Anisakis typica* and *A. alexandri*, from the forestomach of a young specimen from the Napo River in Peru. One case of lobomycosis disease caused by a pathological fungus *Loboa loboi* was reported in an adult female from the estuary of the Surinam river. The other forms of mycosis found were caused by *Glenospora graphii* and *Turulopsis haemalonii*; neither was considered pathological (de Vries and Laarman, 1974). A possible case of toxoplasmosis in wild specimens (Bandoli, 1968), the death of two captive individuals with septicaemia caused by *Proteus morganii* (Greenwood and Taylor, 1979), and the presence of an erysipelothrix-type organism have been reported (Grafton, 1968).

The abundance and status of *Sotalia fluviatilis* populations is unknown or based on mostly qualitative assessments of small geographic areas (da Silva and Best, 1994). In Colombia, the number of individuals at the mouth of the Magdalena River was estimated at between 100–400, and the species was abundant in the Gulf of Cispata (Bössenecker, 1978). It is fairly common at the mouth of large rivers of Surinam, (Husson, 1978) and is frequently seen in the lower reaches and mouth of the Essequibo River in Guyana (Williams, 1928). On the Brazilian coast, the species was reported to be extremely common in the Baía de Guanabara (Goeldi, 1899; Lins de Almeida, 1933; van Bénédien, 1875) with a population of 100 to 400 individuals and a mean density ($\pm SD$) of $5.1 \pm 4.4/\text{km}^2$ ($n = 57$ observations—Geise, 1984). In the Santos and Cananéia regions of São Paulo State (Brazil) it is common, with an estimate of mean density ($\pm SD$) for the area around Cananéia Island of $2,829 \pm 565$ animals (Geise, 1989). In about 500 km of the Solimões River, between Manaus and Tefé, the average density ($\pm SD$) was 1.1 ± 0.4 tucuxi/km of river (Magnusson et al., 1980). Four boat surveys from Manaus to Leticia (about 1,525 km each) gave a mean total ($\pm SD$) of $768 \pm 104.7/\text{trip}$ or 1.02 individuals/ km^2 (da Silva and Best, 1994). Near Iquitos (Peru), 62 tucuxis were counted during 36 h of observation (Kasuya and Kajihara, 1974). The species is also common in Colombia in the Loretoyacu River, the Tarapoto river at the El Correo Lake system, and in the lower reaches of the Orinoco river in Venezuela (Meade and Koehnken, 1991).

Marine *S. fluviatilis* is found in shallow and protected estuarine waters, bays, and the mouth of large rivers, sometimes ascending as far as the limit of tidal influence (Bössenecker, 1978; Duplaix, 1980; Hershkovitz, 1963; Husson, 1978). In Baía de Guanabara, it prefers deep channels (>25 m) and avoids areas <6 m deep (Geise, 1984). Riverine *S. fluviatilis* is found in the main channel of all tributaries as well as in large lakes, but does not enter the flooded forest and avoids rapids (da Silva, 1983, 1986, 1994). It shows a distinct preference for the junction of rivers and channels (Magnusson et al., 1980).

In captivity, *Sotalia fluviatilis* suffers from lung problems and hepatic degeneration (Bössenecker, 1978), shock (Caldwell and

Caldwell, 1970), bronchial pneumonia, acute infective pharyngitus, tracheo-bronchitis (Grafton, 1968), bacterial septicaemia, necrotic intestine, botulism, and gastric ulcers (Greenwood and Taylor, 1979; Spotte, 1967). These animals are very nervous and die easily from shock and capture stress. Many of the 45 individuals captured alive in the Amazon and Colombia during the 1960s and 1970s died during capture, during transport, or after being held in captivity (Collet, 1984). A few animals caught in Colombia in 1977 have survived in captivity and two were still alive in the Nurnberg Zoo, Germany in August 1993 (L. Fersen, pers. comm.). In Colombia, an adult female has been on exhibition since 1986 (S. Kendall, pers. comm.). Two adults and one female calf were introduced into a lagoon in the city of Sete Lagoas, in Minas Gerais State (Brazil), as a tourist attraction in 1985. The two adults died in July 1993, but the calf was still alive in August 1995 (F. Colares, pers. comm.).

Sotalia fluviatilis is protected by legends and myths from Colombia (Bössenecker, 1978) to southern Brazil (van Bénédén, 1875), as well as in the Amazon region (da Silva, 1990). No commercial fisheries have been reported in the past (Mitchell, 1975). On the coast of Brazil, *S. fluviatilis* may occasionally be killed for use as bait for sharks, in shrimp traps, or for human consumption (Barros, 1991; Geise and Borobia, 1987; Perrin, 1989). The greatest direct threats to the species are modern fishing practices, as *S. fluviatilis* is extremely vulnerable to monofilament gill nets. Commercial fishing has increased greatly in recent years, although local fisheries also play an important role in this respect (Lodi and Capistrano, 1990).

Another threat to the tucuxi in the Amazon River basin is development of hydroelectric power facilities that reduce fish fauna abundance (Ferreira, 1984) and fragment the populations by isolating small groups in individual reservoirs (Best and da Silva, 1989). Mercury used in refining fluvial gold has been found in high concentrations in fish identified as part of the tucuxi's diet in the Amazon region and may pose a threat (da Silva, 1983, 1986; Pfeiffer and de Lacerda, 1988), as does pollution from industrial and agricultural areas that destroys the habitat and contaminates the food chain. Large harbors like the Baía de Guanabara (Rio de Janeiro) and Santos (São Paulo) are extremely polluted with effluent, including heavy metals (Amador, 1989; Diegues, 1975) and pose a serious potential threat (Geise, 1989). Mercury and selenium were found in the livers of two specimens from Surinam (Koeman et al., 1973). Exploration for oil in offshore regions of Brazil, Venezuela, and Colombia may directly threaten the marine ecotype because an oil spill could affect the food chain (da Silva and Best, 1994) or impact the tucuxi directly.

BEHAVIOR. Behaviors reported in wild populations include aerial displays such as vertical and lateral full jumps, somersaults, spy-hopping, surfing in waves made by a passing boat (but not bow-riding), tail-lob, lying on the surface belly up and hitting the water with flippers and flukes, rolling on the surface of the water, and diving with tail clear of the water (Borobia, 1984; da Silva, 1983; da Silva and Best, 1994; Geise, 1984, 1989). In contrast, captive specimens rarely show voluntary aerial displays (Terry, 1983, 1986). Other behaviors are slow directional movements, higher travelling speeds, porpoising in a fixed direction, and very slow resting-type movements at the surface (Borobia, 1984; Geise, 1984, 1989).

The two ecotypes of *Sotalia fluviatilis* appear to have very similar social structure that is characterized by small social groups of 1–30 individuals, with a modal number of two per group in the marine tucuxi (Bössenecker, 1978; de Carvalho, 1963; Geise, 1984, 1989; Simões-Lopes, 1988; van Bénédén, 1875; Williams, 1928) and one to six individuals in the riverine ecotype (Magnusson et al., 1980). Groups with more than nine individuals are rarely seen (Best, 1984; da Silva, 1994; Kasuya and Kajihara, 1974; Layne, 1958). The composition of groups is unknown, although there is some evidence that groups of three consist of two adults and one calf and groups of four consist of two calves and two adults (Borobia, 1984; da Silva and Best, 1994; Geise, 1984, 1989). The size and structure of groups varies according to time of day and type of activity (Geise, 1989). *S. fluviatilis* is relatively sedentary and apparently not territorial. It can occur throughout the year in the same area (Andrade et al., 1987; Borobia, 1984; da Silva, 1983; Geise, 1984, 1989; Magnusson et al., 1980; Simões-Lopes, 1988).

Sotalia fluviatilis has a distinct diurnal rhythm; in Baía de Guanabara and Cananéia regions, 90% of tucuxis entered the bay

around 0600–0800 h and all left between 1300 and 1900 h (Borobia, 1984; Geise, 1984, 1989). In the Amazon River drainage, tucuxi seem more active than usual between 0900 and 1000 h, and there is a marked movement into lakes from rivers before about 0900 h and from lakes to rivers from 1600 to 1800 h (da Silva and Best, 1994; Layne, 1958).

Sotalia fluviatilis produces echolocation clicks at 8–15 kHz, 30 kHz, and 95 kHz. Clicks may be single or twin pulses, called paired clicks (Norris et al., 1972), and are produced at rates between 600/s and 960/s (Nakasai and Takemura, 1975; Norris et al., 1972; Wiersma, 1982). Repetition rates are usually in the range of 10–70/s when cruising. Short pulses and high repetition rates allow discrimination of objects at distances <15 cm. Simple whistles have been reported in the wild riverine ecotype (Norris et al., 1972) and, in captivity, short, pure tone whistles rising in frequency have been recorded when the animals were agitated (Terry, 1983). Simultaneous clicks having different frequencies (kHz \pm SD) and duration (ms \pm SD) have been recorded (frequencies 94.7 \pm 1.4 and 29.2 \pm 0.7; durations 27.7 \pm 0.7 and 98.7 \pm 3.7; Wiersma, 1982). Dissimilar sonar signals were found between the two ecotypes of *S. fluviatilis*; clicks of both forms are characterized by a larger band width with the same dominant frequency, but no paired clicks were recorded (Kammenga et al., 1993).

Compared to *Tursiops truncatus*, *Sotalia fluviatilis* exhibit less curiosity, manipulation and play, leaping/surface behavior, and care-giving behavior. The only behavior that *Sotalia fluviatilis* exhibits with greater frequency than *T. truncatus* is aggression towards other cetacean species (Defran and Pryor, 1980; Terry, 1986).

Aggressive behavior is common between males during the breeding season. When excited, they may flex the body and glide in an inverted-U posture. Copulation is belly to belly and is often preceded by tactile contact and masturbation. Homosexual behavior in captivity is rarely seen in this species (Terry, 1983). In the Amazon River basin, reproduction is synchronized with annual flood cycles (Best and da Silva, 1984).

In captivity, intergeneric behavior between male *Inia geoffrensis* and *Sotalia fluviatilis*, and between *S. fluviatilis* and *T. truncatus*, has been reported (Spotte, 1967). Although wild tucuxi do not interact often with the Amazon River dolphin *Inia geoffrensis*, they have been seen in close proximity to feeding groups (da Silva, 1983). A group of tucuxi has been seen to expel *I. geoffrensis* from a particular location (Layne, 1958), although an adult tucuxi was seen playing with a calf of this species (da Silva and Best, 1994). Tucuxi feed in association with terns (*Phaetusa simplex*) in the Amazon (da Silva, 1983) and with two species of seabirds (*Sula leucogaster* and *Sterna* sp.) in Santa Catarina State (Simões-Lopes, 1988).

Fishing behavior may consist of random slow movements with occasional high bursts of speed as tucuxi chase fish along the surface. A coordinated group may consist of several subgroups working in conjunction and may involve other species of dolphins. They may herd a school of fish against a steep mud bank and then attack in unison, or circle a school of fish and converge simultaneously towards the center (Borobia, 1984; da Silva, 1983; Geise, 1984, 1989). Riverine *Sotalia fluviatilis* sometimes feed in areas of great turbulence, such as mouths of rivers or steep river banks, and may even use gillnets as a wall to force the pursued fish schools to scatter (da Silva, 1983, 1986).

REMARKS. The most common name of *Sotalia fluviatilis* in the Amazon region is tucuxi. This name originates from the Tupi language of the Mayanas Indians (*tucuchi-una*). In Peru, it is called bufeo negro or bufeo gris (Gray, 1856; Neville et al., 1976), in Venezuela tonina (Osgood, 1912), in Nicaragua local fishermen call them lam (T. Carr and R. K. Bond, in litt.), and Guyana dolphin or Surinam dolphin in Surinam (Bössenecker, 1978; Husson, 1978; van Bree, 1975). Along the coast of Brazil, it is referred as boto or boto comum (da Silva and Best, 1994; Pinedo et al., 1992).

The species has been listed under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (Appendix I) since 1982 as *Sotalia* spp., and considered as "insufficiently known" by the World Conservation Union—IUCN (Klinowska, 1991). In Brazil, it is protected by the Federal Fisheries Law (Decreto Lei N° 73.632 de Fevereiro de 1967). The freshwater population is also protected by Fauna Protection Law No. 5197 of March 1967.

We would like to thank G. Nakamura for his comments on an

early manuscript and especially A. Martin, F. Rosas, and A. V. Linzey for their helpful suggestions and reviews of the manuscript. Edinaldo N. dos S. Silva helped with the skull photographs and D. Hughes kindly drew the map. The Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq)/Instituto Nacional de Pesquisas da Amazônia (INPA)—Brazil, the British Council, and St John's College, Cambridge have supported our work. Comments on the manuscript were received from W. Perrin and D. Odell. Robin C. Best passed away on December 17, 1986.

LITERATURE CITED

ACKMAN, R. G., C. A. EATON, J. KINNEMAN, AND C. LITCHFIELD. 1975. Lipids of freshwater dolphin *Sotalia fluviatilis*: comparison of odontocete bioacoustic lipids and habitat. *Lipids*, 10:44–49.

AMADOR, A. DA S. 1989. Assoreamento da Baía de Guanabara. *Taxas de sedimentação*. Anais da Academia Brasileira de Ciências, 52:723–742.

ANDRADE, L. DE, S. SICILIANO, AND L. CAPISTRANO. 1987. Movimentos e atividades do boto *Sotalia guianensis* (Cetacea, Delphinidae) na Baía de Guanabara, Rio de Janeiro. Pp. 49–56, in *Actas da Segunda Reunião de Especialistas em Mamíferos Aquáticos da América do Sul*, Rio de Janeiro, Brasil. (Fundação Brasileira para a Conservação da Natureza), 199 pp.

BANDOLI, J. G. 1968. Sobre a ocorrência de lesões por organismos semelhantes a toxoplasmas em *Sotalia guianensis* (van Béden, 1863). Cetacea, Delphinidae. Anais XI Congresso Brasileiro de Veterinária, Niterói, 1:282–284.

BARROS, N. B. 1991. Recent cetacean records for southeastern Brazil. *Marine Mammal Science*, 7:296–306.

BEST, R. C. 1984. The aquatic mammals and reptiles of the Amazon. Pp. 371–412, in *The Amazon: limnology and landscape ecology of mighty tropical river and its basin* (H. Sioli, ed.). Dr. W. Junk Publisher, Dordrecht, 763 pp.

BEST, R. C., AND V. M. F. DA SILVA. 1984. Preliminary analysis of reproductive parameters of the boutu, *Inia geoffrensis*, and the tucuxi, *Sotalia fluviatilis*, in the Amazon River system. Pp. 361–369, in *Reports of the International Whaling Commission*, Special Issue 6:1–495.

—. 1989. Biology, status and conservation of *Inia geoffrensis* in the Amazon and Orinoco river basin. Pp. 23–34, in *Biology and conservation of the river dolphins* (W. F. Perrin, R. L. Brownell, Jr., Z. Kaiya, and L. Jiankang, eds.). International Union for Conservation of Nature and Natural Resources (IUCN), Species Survival Commission, Occasional Paper, 3:1–173.

BEST, R. C., J. M. DA ROCHA, AND V. M. F. DA SILVA. 1986. Registro de pequenos cetáceos na costa nordeste Brasileira. Pp. 23–32, in *Actas de la 1ª Reunión de Expertos en Mamíferos Acuáticos de América del Sur*, Buenos Aires (Fundacion Vida Silvestre Argentina), 236 pp.

BITTENCOURT, M. L. 1984. Primeira ocorrência de *Sotalia brasiliensis* bôto, Cetacea, Delphinidae, para a Baía de Paranaguá, litoral paranaense, Brasil. Arquivo de Biologia e Tecnologia do Paraná, 27:95–98.

BOROBIA, M. 1984. Comportamento e aspectos biológicos dos botos da Baía de Guanabara, *Sotalia* sp. B.Sc. thesis, State University of Rio de Janeiro—Universidade Federal do Rio de Janeiro (UFRJ), Rio de Janeiro, 81 pp.

—. 1989. The distribution and morphometrics of *Sotalia fluviatilis*. M.Sc. thesis, McGill University, Montreal, Canada, 81 pp.

BOROBIA, M., AND N. B. BARROS. 1989. Notes on the diet of marine *Sotalia fluviatilis*. *Marine Mammal Science*, 5:395–399.

BOROBIA, M., AND D. E. SERGEANT. in press. Variation in skull morphology of South American dolphins of the genus *Sotalia*, in *Proceedings of the Cetacean Systematics Symposium* (L. Barnes, W. F. Perrin and J. E. Heyning, eds.). Allen Press, Lawrence, Kansas.

BOROBIA, M., S. SICILIANO, L. LODI, AND W. HOEK. 1991. Distribution of the South American dolphin *Sotalia fluviatilis*. *Canadian Journal of Zoology*, 69:1025–1039.

BÖSSENECKER, P. G. 1978. The capture and care of *Sotalia guianensis*. *Aquatic Mammals*, 6:13–17.

BROOKS, D. R., T. B. THORSON, AND M. A. MAYER. 1981. Freshwater stingrays (Potamotrygonidae) and their evolution and co-evolution. Pp. 147–175, in *Advances in cladistics* (V. A. Funk and D. R. Brooks, eds.). New York Botanic Garden, New York, 250 pp.

CALDWELL, D. K., AND M. C. CALDWELL. 1970. Echolocation type signals by two dolphins, genus *Sotalia*. *Quarterly Journal of Florida Academy of Sciences*, 33:124–131.

CASINOS, A., F. BISBAL, AND S. BOHER. 1981. Sobre tres exemplares de *Sotalia fluviatilis* do Lago Maracaibo (Venezuela) (Cetacea, Delphinidae). *Publicaciones del Departamento de Zoología*, Barcelona, 7:93–96.

CASTELLO, H. P., AND PINEDO, M. C. 1986. Sobre unas avistajes en el mar de distintas especies de cetáceos en el sur del Brasil. Pp. 61–68, in *Actas de la 1ª Reunión de Expertos en Mamíferos Acuáticos de América del Sur*, 236 pp.

CHAVES, P. DE T. C., AND V. M. F. DA SILVA. 1988. Aspectos do trato digestivo de *Sotalia fluviatilis* (Cetacea, Delphinidae): esôfago e estômago. *Revista Brasileira de Zoología*, 5:89–99.

COLLET, A. 1984. Live capture of cetaceans for European institutions. *Report of the International Whaling Commission*, 34: 603–607.

DA SILVA, V. M. F. 1983. Ecología alimentar dos golfinhos da Amazônia. M. Sc. thesis, Instituto Nacional de Pesquisas da Amazônia/University of Amazonas, Manaus, 118 pp.

—. 1986. Separação ecológica dos golfinhos de água doce da Amazônia, com considerações sobre a pesca comercial. Pp. 215–227, in *Actas de la 1ª Reunión de Expertos en Mamíferos Acuáticos de la América del Sur*, Buenos Aires (Fundacion Vida Silvestre Argentina), 236 pp.

—. 1990. Botos, mitológicos hóspedes da Amazônia. *Ciência Hoje*, 11:14–18.

—. 1994. Aspects of the biology of the Amazonian dolphins genus *Inia* and *Sotalia fluviatilis*. Ph.D. dissert., University of Cambridge, Cambridge, UK, 327 pp.

DA SILVA, V. M. F., AND R. C. BEST. 1994. Tucuxi, *Sotalia fluviatilis* (Gervais) 1853. Pp. 43–69, in *Handbook of marine mammals. Volume 5* (S. H. Ridgway and R. J. Harrison, eds.). Academic Press, London, 416 pp.

DE CARVALHO, C. T. 1961. Esboço mastofaunístico do Território do Rio Branco. *Revista Biología Tropical*, 9:1–15.

—. 1963. Sobre um boto comum no litoral do Brasil (Cetacea; Delphinidae). *Revista Brasileira de Biología*, 23:263–267.

DEFRAN, R. H., AND K. PRYOR. 1980. The behaviour and training of cetaceans in captivity. Pp. 319–362, in *Cetacean behaviour: mechanisms and functions* (L. M. Herman, ed.). John Wiley & Sons Publisher, New York, 463 pp.

DE VRIES, G. A., AND J. J. LAARMAN. 1974. A case of Lobos's disease in the dolphin *Sotalia guianensis*. *Aquatic Mammals*, 1:263.

DIEGUES, A. C. S. 1975. Processos naturais e processos sociais num ecossistema estuarino, São Paulo. *Revista do Instituto Oceanográfico/Universidade de São Paulo*, ed.), 139 pp.

DUPLAIX, N. 1980. Observations of the ecology and behaviour of the giant river otter *Pteronura brasiliensis* in Suriname. *Revue de Ecologie (Terre vie)*, 34:495–620.

FERREIRA, E. J. G. 1984. A ictiofauna da Represa hidrelétrica de Curuá-Una, Santarém, Pará. I—Lista e distribuição das espécies. *Amazoniana*, 8:351–363.

FRASER, F. C. 1966. Comments on the Delphinoidea. Pp. 7–31, in *Whales, Dolphins and porpoises* (K. Norris, ed.). University of California Press, Berkeley, 789 pp.

GEISE, L. 1984. Distribuição geográfica e estimativa populacional dos botos da Baía de Guanabara, Rio de Janeiro, *Sotalia* sp. B. S. thesis, Universidade Federal do Rio de Janeiro State, Rio de Janeiro, 66 pp.

—. 1989. Estrutura social, comportamental e populacional de *Sotalia* sp. (Gray, 1886) (Cetacea, Delphinidae) na região estuarino-lagunar de Cananéia, SP e na Baía de Guanabara, RJ. M.Sc. thesis, Universidade de São Paulo, São Paulo, 198 pp.

GEISE, L., AND M. BOROBIA. 1987. New Brazilian records for *Kogia*, *Pontoporia*, *Grampus*, and *Sotalia* (Cetacea, Physeteridae, Platanistidae, and Delphinidae). *Journal of Mammalogy*, 68:873–875.

—. 1988. Sobre a ocorrência de cetáceos no litoral do Rio

de Janeiro, entre 1968 e 1984. *Revista Brasileira de Zoologia*, 4:341-346.

GERVAIS, P. 1853. Remarques sur les mammifères marins qui fréquentent les côtes de la France et plus particulièrement sur une nouvelle espèce de Dauphin propre à la Méditerranée. *Bulletin de la Société Centrale d'Agriculture et des comices agricoles du département de l'Hérault (Montpellier)*, 40 année (Avril, Main, Juin), 140-156.

—. 1855. Description des trois espèces de dauphins qui vivent dans la région du haut Amazone. Pp. 89-94, in F. de Castelnau, *Expedition dans les parties centrales de L'Amérique du Sud, du Rio de Janeiro a Lima et de Lima au Pará*, 7, *Zoology* (P. Bertrand, ed.). Paris, 480 pp.

GIBSON, D. I., AND E. A. HARRIS. 1979. The helminth parasites of cetaceans in the collection of the British Museum (Natural History). *Investigations on Cetacea*, 10:309-324.

GOELDI, E. A. 1899. Biologische miscellen aus Brasiliens. IV. Bemerkungen zur osteologie des delphins aus der bucht von Rio de Janeiro (*Sotalia brasiliensis* E. van Bénédén). *Zool. Jahrb. Abtheil. F. Syst. Geogr. Bio. Thiere, Part A*, 3:134-142.

GRAFTON, T. S. 1968. Necropsy of a sacred dolphin of the Amazon (*Sotalia fluviatilis*). Pp. 19-25, in *Symposium of disease and husbandry of aquatic mammals* (D. K. Caldwell and M. C. Caldwell, eds.). Marineland Research Laboratory, St. Augustine, Florida, 158 pp.

GRAY, J. E. 1856. Description of a new species of dolphin (*Steno*) from the upper parts of the river Amazon. *Annals and Magazine of Natural History*, 18:157-159.

—. 1866a. Catalogue of seals and whales in the British Museum. Second ed. London, 403 pp.

—. 1866b. Notes on the skulls of dolphins or bottlenosed whales, in the British Museum. *Proceedings of the Zoological Society, London* (1865):211-216.

GREENWOOD, A. G., AND D. C. TAYLOR. 1979. Clinical and pathological findings in dolphins in 1978. *Aquatic Mammals*, 7:71-74.

GREENWOOD, A. G., D. C. TAYLOR, AND A. GAUCKLER. 1979. Odontocete parasites—some new host records. *Aquatic Mammals*, 7:23-25.

GRIMWOOD, I. R. 1969. Notes on the distribution and status of some Peruvian mammals. Special Publication, American Committee for International Wildlife Protection and New York Zoological Society, 21:1-86 pp.

HARRISON, R. J., AND R. L. BROWNELL. 1971. The gonads of the South American dolphins, *Inia geoffrensis* and *Sotalia fluviatilis*. *Journal of Mammalogy*, 52:413-419.

HERALD, E. S. 1967. Boutu and tookushee—Amazon dolphins. *Pacific Discovery*, 20:2-9.

HERSHKOVITZ, P. 1963. Notes on the South American dolphins of the genera, *Inia*, *Sotalia* and *Tursiops*. *Journal of Mammalogy*, 44:98-103.

HUSSON, A. W. 1978. The mammals of Surinam. E. J. Brill, Leiden, 569 pp.

KAMMINGA, C., M. T. VAN HOVE, F. J. ENGLESMA, AND R. P. TERRY. 1993. Investigations on cetacean sonar X: a comparative analysis of underwater echolocation clicks of *Inia* spp. and *Sotalia* spp. *Aquatic Mammals*, 19:31-43.

KASUYA, T., AND T. KAJIHARA. 1974. Ecology of dolphins in the Amazon and Orinoco systems. Pp. 7-11, in *Report of Scientific Expedition on the La Plata and Amazon dolphins*. University of Tokyo, Freshwater dolphin expedition, Tokyo, 93 pp. (translated from Japanese).

KLINOWSKA, M. 1991. Dolphins, porpoises and whales of the world. Pp. 429, in *The IUCN red data book*. The World Conservation Union (IUCN), Gland, Switzerland, 429 pp.

KOEMAN, J. H., W. H. M. PEETERS, AND C. H. M. KOUDSTAAL. 1973. Mercury-selenium correlations in marine mammals. *Nature*, 254:385-386.

LAYNE, J. N. 1958. Observations on freshwater dolphins in the upper Amazon. *Journal of Mammalogy*, 39:1-22.

LINS DE ALMEIDA, J. 1933. Nouveau nematode parasite de cétoques du Brésil, *Halocercus brasiliensis* n. sp. *Comptes Rendus de la Societe de Biologie*, 114:955-958.

LITCHFIELD, C., A. J. J. GREENBERG, D. K. CALDWELL, M. C. CALDWELL, J. C. SIPOS, AND R. G. A. ACKMAN. 1975. Comparative lipid patterns in acoustical and non acoustical fatty tissue of dolphins, porpoises and toothed whales. *Comparative Biochemistry and Physiology*, 50:591-597.

LODI, L., AND L. CAPISTRANO. 1990. Capturas accidentais de pequenos cetáceos no litoral norte do estado do Rio de Janeiro. *Biotemas*, 3:47-65.

MAGNUSSON, W. E., R. C. BEST, AND V. M. F. DA SILVA. 1980. Numbers and behaviour of Amazonian dolphins, *Inia geoffrensis* and *Sotalia fluviatilis* in the rio Solimões, Brasil. *Aquatic Mammals*, 8:27-41.

MARTIN, A. R. 1990. Whales and dolphins. Salamander Books, London, 192 pp.

MEAD, J. G. 1975. Anatomy of the external nasal passages and facial complex in the Delphinidae (Mammalia: Cetacea). *Smithsonian Contribution in Zoology*, 207:1-72.

MEADE, R. H., AND L. KOEHNKEN. 1991. Distribution of the river dolphin, tonina *Inia geoffrensis* in the Orinoco river basin of Venezuela and Colombia. *Interciencia*, 16:300-312.

MITCHELL, E. 1975. Review of biology and fisheries for smaller cetaceans. *Journal of Fisheries and Research Board of Canada*, 32:875-1240.

MORGANE, P., AND M. S. JACOBS. 1972. Comparative anatomy of the cetacean nervous system. Pp. 117-244, in *Functional anatomy of marine mammals*, Vol. 1 (R. J. Harrison, ed.). Academic Press, London, 451 pp.

NAKASAI, K., AND A. TAKEMURA. 1975. Studies on underwater sounds—VI. On the underwater calls of freshwater dolphins in South America. *Bulletin Faculty Fisheries of Nagasaki University*, 40:7-13.

NESS, A. R. 1967. A measure of symmetry of the skulls of odontocete whales. *Journal of Zoology (London)*, 153:209-221.

NEVILLE, M., N. CASTRO, A. MARMOL, AND J. REVILLA. 1976. Censusing primate populations in the reserved area of the Pacaya and Samira rivers, Departamento Loreto, Peru. *Primates*, 17:151-181.

NORRIS, K. S., G. W. HARVEY, L. A. BUZNELL, AND T. D. K. KARTHA. 1972. Sound production in the freshwater porpoises *Sotalia fluviatilis* Gervais and Deville, and *Inia geoffrensis* Blainville, in the Rio Negro, Brasil. *Investigations on Cetacea*, 4:251-260.

NOWAK, R. M., AND J. L. PARADISO. 1983. *Walker's mammals of the world*. Fourth ed. The Johns Hopkins University Press, Baltimore, 1:1-568, 2:569-1362.

OBREGON, C., F. TORRES, AND F. TRUJILLO. 1988. Colombian dolphins. *Whalewatcher*, 22:21.

OSGOOD, W. H. 1912. Mammals from western Venezuela and eastern Colombia. *Field Museum of Natural History, Zoology Series*, 10:33-66.

O'SHEA, T. J., M. CORREA-VIANNA, M. E. LUDLOW, AND J. G. ROBINSON. 1986. Distribution and status of the West Indian manatee in Venezuela. Report to the International Union of Conservation for Nature and Natural Resources, 9132 (not seen, cited in Borobia et al., 1991).

PERRIN, W. F. 1989. Dolphins, porpoises and whales. An action plan for the conservation of biological diversity: 1988-1992. Second ed. International Union for Conservation of Nature and Natural Resources, Gland, Switzerland, 39 pp.

PERRIN, W. F., AND S. B. REILLY. 1984. Reproductive parameters of dolphins and small whales of the family Delphinidae. Pp. 97-188, in *Reports of the International Whaling Commission*. Special Issue, 6:1-495.

PFEIFFER, W. C., AND L. D. DE LACERDA. 1988. Mercury inputs into the Amazon region, Brazil. *Environmental Technology Letters*, 9:325-330.

PILLERI, G. 1979. Observations on the ecology of *Inia geoffrensis* from the Rio Apure, Venezuela. *Investigations on Cetacea*, 10: 136-142.

—. 1982. Observation on the behaviour, sense of vision and sonar field of some cetaceans in captivity. *Investigations on Cetacea*, 13:167-176.

PINEDO, M. C. 1985. Intentional and incidental capture of marine mammals in fishing nets. Pp. 76-79, in *Conclusiones de la primera reunión de trabajo de expertos en mamíferos acuáticos de América del Sur*. Buenos Aires (Fundación Vida Silvestre Argentina), 236 pp.

PINEDO, M. C., F. C. W. ROSAS, AND M. MARMONTEL. 1992. Cetáceos e pinnípedos do Brasil. Uma revisão dos registros e guia para identificação das espécies. Fundação Universidade do

Amazonas/United Nations Environmental Program, Manaus, 213 pp.

SCHMIEGELOW, J. M. M. 1990. Estudo sobre Cetáceos Odontocetos encontrados em praias da região entre Iguapé (SP) e Baía de Paranaguá (PR) (24°42'S–25°28'S), com especial referência a *Sotalia fluviatilis* Cervais, 1853 (Delphinidae). M.Sc. thesis, Instituto Oceanográfico, Universidade de São Paulo, Brasil, 104 pp.

SIMÕES-LOPES, P. 1988. Ocorrência de uma população de *Sotalia fluviatilis* Gervais, 1853 (Cetacea, Delphinidae) no limite sul da sua distribuição, Santa Catarina, Brasil. Biotemas, 1:57–62.

SPOTTE, S. H. 1967. Intergeneric behaviour between captive Amazon river dolphin *Inia* and *Sotalia*. Underwater Naturalist, 4:9–13.

TERRY, R. P. 1983. Observations on the captive behaviour of *Sotalia fluviatilis guianensis*. Aquatic Mammals, 10:95–105.

—. 1986. The behaviour and trainability of *Sotalia fluviatilis guianensis* in captivity: a survey. Aquatic Mammals, 12: 71–79.

TREBBAU, P., AND P. J. H. VAN BREE. 1974. Notes concerning the freshwater dolphin *Inia geoffrensis*, (de Blainville, 1817) in Venezuela. Zeitschrift des Saugetierkunde, 39:50–57.

VAN BÉNÉDEN, E. 1875. Mémoire sur un dolphin nouveau de la Baie de Rio de Janeiro. Mémoires de l' Académie Royale de Sciences Belgique, 41:2–44.

VAN BÉNÉDEN, P. J. 1864. Sur un dolphin nouveau et un ziphioide rare. Mémoires de l' Académie Royale de Sciences Belgique, 16:1–21.

VAN BÉNÉDEN, P. J., AND P. GERVAIS. 1880. Osteographie des cétacés vivant et fossiles. Arthur Bertrand, Librairie, Editeur, Paris, 634 pp.

VAN BREE, P. J. H. 1975. Preliminary list of cetaceans of southern Caribbean. Studies on the fauna of Curaçao and other Caribbean islands, 48:79–87.

VAN FOREST, A. W. 1980. Haematologic findings in *Sotalia fluviatilis guianensis*. Aquatic Mammals, 8:15–18.

VIDAL, O. 1990. Lista de los mamíferos acuáticos de Colombia. Informe del Museo del Mar (Universidad de Bogotá Jorge Tadeo Lozano), 37:1–18.

WERDER, U., AND C. E. ALHANTI. 1981. Informe sobre um tubarão (*Carcharhinus leucas*) capturado no Amazonas com alguns detalhes de sua morfologia externa. Acta Amazonica, 11: 193–196.

WIERMSMA, H. 1982. Investigaciones on cetacean sonar IV. A comparison of wave shapes of odontocete sonar signals. Aquatic Mammals, 9:57–66.

WILLIAMS, S. H. 1928. A river dolphin from Kartabo, Bartica District, British Guiana. Zoologica, 8:105–128.

ZAM, S. G., D. K. CALDWELL, AND M. C. CALDWELL. 1970. Some internal parasites from freshwater cetaceans from the upper Amazon River. Investigations on Cetacea, 2:250–251.

Editors of this account were GUY N. CAMERON, ALICIA V. LINZEY, ELAINE ANDERSON, AND KARL F. KOOPMAN. Managing editor was ALICIA V. LINZEY.

V. M. F. DA SILVA AND R. C. BEST*, INSTITUTO NACIONAL DE PESQUISAS DA AMAZÔNIA-INPA, LABORATÓRIO DE MAMÍFEROS AQUÁTICOS, C. P. 478, 69011-970, MANAUS, AM, BRAZIL. *DECEASED